Isochoric Heat Capacity and PVT Measurements for Toluene Near Phase Transitions and the Critical Point

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New isochoric heat capacity C_V and *PVT* measurements for toluene near phase transitions and the critical point will be presented. Measurements were made using a high- temperature, high-pressure, adiabatic, and nearly constant-volume calorimeter. The inner volume of the calorimeter is 440.43±0.05 cm^3 at temperature of 296.65 K and a pressure of 0.1 MPa. Changes in the volume of the calorimeter due to changes in temperature ΔV_T and pressure ΔV_P were determined both experimentally and by calculations. The heat capacity of the empty calorimeter C_0 was measured using reference fluids (n-heptane and helium) with well-known (uncertainties 0.5% and 0.1%, respectively) isobaric heat capacities at 0.1 MPa. The average value of C_0 is about 232 $J \cdot K^{-1}$ in a temperature range between 390 and 670 K. The temperature of the sample was measured with a *PRT (PTS-10)*. The uncertainty in the temperature measurements is less than ±10mK. Uncertainties of the heat capacity measurements are estimated to be 2 to 3 %. Measurements were made in the two-phase and one-phase regions. The experimental values of phase transition temperatures $T_S(\rho)$, one- and two-phase isochoric heat capacities (C_{V1},C_{V2}) on each measured isochore were determined using a quasi-static thermogram method. Measurements have been made along 10 near-critical isochores between 232 and 348 $kg \cdot m^{-3}$ in the temperature range from 570 to 615 K. The temperature dependence of derived properties including isochoric heat capacity jumps ΔC_V, second temperature derivatives of some the vapor-pressure and chemical potential along the coexistence curve will be discussed.

The calorimeter was used also as a piezometer to obtain isochoric *PVT* measurements. The experimental values of the *PVT* and temperature derivatives of pressure $(\partial P/\partial T)_V$ along the each measured isochore will be presented.